

Notice of Allowability

Application No.

10/649,271

Applicant(s)

MINTON, JOSEPH GRAYSON

Examiner

Herng-der Day

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Response and Amendment received 6/12/07.
2. ☒ The allowed claim(s) is/are 1-4, 8-14, and 17-19, now renumbered as 1-14.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


KAMINI SHAH
SUPERVISORY PATENT EXAMINER

DETAILED ACTION

1. This communication is in response to Applicant's Response and Amendment to Office Actions dated January 26, 2007, filed June 12, 2007, and telephone interview conducted June 18, 2007.

1-1. Claims 1-4, 9-14, 17, and 19 have been amended. Claims 5-7 and 15-16 have been cancelled. Claims 1-4, 8-14, and 17-19 are pending.

1-2. Claims 1-4, 8-14, and 17-19 have been examined and allowed.

EXAMINER'S AMENDMENT

2. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

3. Authorization for this Examiner's amendment was given in a telephone interview with Mr. Peter E. Rosden (Reg. No.: 32,532) on June 18, 2007.

4. The claims have been amended as follows:

4-1. Replace claim 1 as follows:

Claim 1 (currently amended) A computer-implemented method using a computer having a display and a memory for storage of information representative of hydrologic and hydraulic conditions for determining water flow directions based on flow vector values calculated in part with a D8 method applied to a watershed divided into more than one predefined, rectangular

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major cell each encompassing a minimum of nine predefined, rectangular minor cells including a center minor cell and eight neighbor minor cells wherein the watershed includes one or more types of problem areas identified as depressions, flat areas or peaks each of which extends across more than one major cell and each of which requires fixing and wherein further the number, location and elevation of all minor cells are known as are a maximum depth depression to be corrected, a maximum number of downstream minor cells to check in fixing depressions and peaks, a largest depression area to fix and a largest flat area to fix, comprising:

selecting and designating one major cell for which to begin generating flow vector values;
creating a buffered array in the memory containing elevation and identification data for all minor cells in the designated major cell and all major cells bordering the designated major cell;

calculating flow vector values for each minor cell within the buffered array using the D8 method wherein a flow vector value of zero is assigned to any minor cell located in a problem area for which a flow vector value cannot be calculated using the D8 method;

storing in the memory the calculated flow vector values in association with the minor cell to which they relate;

checking the flow vector value of each minor cell within the designated major cell until all cells have been checked and all cells having a flow vector value of zero have been found;

assigning a problem type in the memory to each minor cell within the designated major cell having a flow vector value of zero;

fixing first all minor cells in the designated major cell to which a depression problem type has been assigned wherein depressions are fixed independently and successively from the highest

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depression to the lowest depression and elevation changes are imposed on minor cells in the buffered array, as required;

fixing second all minor cells in the designated major cell to which a flat area problem type has been assigned wherein each flat area is fixed independently and elevation changes are imposed on minor cells in the buffered array, as required;

fixing third all minor cells in the designated major cell to which a peak problem type has been assigned wherein peaks are fixed independently and successively from the lowest peak to the highest peak and elevation changes are imposed on minor cells in the buffered array; as required;

recalculating and storing in the memory flow vector values for each minor cell within the buffered array using the D8 method wherein a flow vector value of zero is assigned to any minor cell located in a problem area for which a flow vector value cannot be calculated using the D8 method;

checking again the flow vector value of each minor cell within the designated major cell until all cells have been checked and all cells having a flow vector value of zero, if any, are found;

if any minor cells having a flow vector value of zero have been found,

assigning a problem type in the memory to each minor cell having a flow vector value of zero;

fixing first all minor cells in the designated major cell to which a depression problem type has been assigned wherein depressions are fixed independently and successively

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from the highest depression to the lowest depression by imposing elevation changes on minor cells in the buffered array, as required;

fixing second all minor cells in the designated major cell to which a flat area problem type has been assigned wherein each flat area is fixed independently by imposing elevation changes on minor cells in the buffered array, as required;

fixing third all minor cells in the designated major cell to which a peak problem type has been assigned wherein peaks are fixed independently and successively from the lowest peak to the highest peak and elevation changes are imposed on minor cells in the buffered array, as required;

storing in the memory the elevation and flow vector value associated with each minor cell as changed, if necessary;

selecting and designating a previously unselected major cell and repeating the process beginning with creating a buffered array; and

retrieving the elevation and flow vector value for the watershed stored in the memory to depict on the display at least one of a basin delineation, flowpath tracing, drainage area calculation, the extents of hazardous waste spills and a streamline.

4-2. Replace claim 3 as follows:

Claim 3 (currently amended) The method of claim 1 wherein assigning for each minor cell having a zero flow vector value further comprises:

obtaining the location and elevation of all neighbor minor cells of the ~~center~~ minor cell;

if the minor cell is at the edge of the buffered array, assigning the problem type as “edge”;

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otherwise, calculating the slope from the minor cell to each of its eight[[,]] surrounding neighbor cells in order to find a maximum slope and,

if the elevation of the minor cell is lower than each of those neighbor minor cells, assigning the problem type as “depression”;

if the maximum slope from the ~~center~~ minor cell to one or more neighbor minor cells equals zero assigning the problem type as “flat”; and

if the maximum slope from the ~~center~~ minor cell to more than one neighbor minor cell does not equal zero, assigning the problem type as “peak”.

4-3. Replace claim 4 as follows:

Claim 4 (currently amended) The method of claim 1 wherein fixing first is a subroutine comprising:

initializing a first variable in the memory to track [[the]] a highest depression elevation found;

flagging in the memory that original minor cell in the designated major cell having a zero flow vector value which has [[the]] a highest elevation as compared with all other minor cells having zero flow vector values located in the designated major cell;

retrieving from the memory location and elevation data for the flagged original minor cell and its neighbor minor cells;

setting an initial depth limit in the memory to a preselected amount to limit the maximum depth depression to correct;

initializing a second variable in the memory to track the number of times the maximum depth depression has been modified up to a preselected maximum number of times;

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creating a depression array in the memory mirroring the buffered array for identifying those minor cells which contribute to the depression;

increasing second variable in the memory by one;

defining ~~[[the]]~~ an area contributing to the depression;

identifying potential outlets from the depression;

determining whether any of the potential outlets from the depression is a good outlet;

if no good outlet is found,

 exiting the subroutine if

 the contributing area extends beyond the buffered array; or

 the number of maximum depth modification attempts equals the preselected maximum number of times;

 otherwise, incrementing the depth limit in the memory by an amount equal to one-eighth of the initial depth limit;

 if the depth limit is greater than the combination of the elevation of the flagged original minor cell and the initial depth limit ~~as originally set~~, exiting the subroutine;

 otherwise, returning to creating a depression array;

if a good outlet exists,

 choosing the good outlet having the lowest elevation;

 drawing a hypothetical straight line in the memory from the center of the flagged original minor cell to the good outlet cell;

 extending the hypothetical straight line in the memory to follow a downstream path to an elevation lower than the elevation of the flagged original minor cell;

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burning a cutline into the buffered array in the memory by correcting elevations in minor cells, as necessary;

recalculating and storing in the memory the flow vector values for all minor cells in the buffered array ~~if the depression is fixed~~; and

~~until~~ unless all depressions are fixed or there is no more data, returning to flagging.

4-4. Replace claim 8 as follows:

Claim 8 (currently amended) The method of claim 4 wherein the initial depth limit is ~~initially~~ set at one-half of the originally specified maximum depth depression.

4-5. Replace claim 9 as follows:

Claim 9 (currently amended) The method of claim 4 wherein defining further comprises:

obtaining data identifying the location and elevation of a center minor cell;

testing each of the eight neighbor minor cells surrounding the center minor cell to determine if the elevation of any neighbor minor cell is greater than or equal to the elevation of the center minor cell;

if so, flagging the center minor cell as a contributing minor cell and redesignating that neighbor minor cell as the center minor cell if the elevation of the neighbor minor cell is less than the initial depth limit and the neighbor minor cell is not located at the edge of the buffered array;

returning to obtaining data until all neighbor minor cells of all minor cells in the buffered array have been tested or until a stack space error is encountered or the center minor cell is determined to be located at the edge of the buffered array in which case the subroutine is exited.

4-6. Replace claim 10 as follows:

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Claim 10 (currently amended) The method of claim 9 including the following after defining:

if an error is encountered during the defining,

exiting the subroutine if stack space has been exceeded, the area has already been flagged as too shallow or the preselected maximum number of times to attempt fixing the depression array has been reached;

incrementing the depth limit;

if the depth limit after incrementing is ~~not less than the original elevation~~ less than the elevation of the flagged original minor cell plus the initial depth limit,

resetting the depression array;

incrementing the second variable by one; and

returning to defining;

otherwise, exiting the subroutine ~~if the depth limit after incrementing is less than the original elevation~~.

4-7. Replace claim 13 as follows:

Claim 13 (currently amended) The method of claim 12, wherein determining is a further subroutine further comprising:

obtaining data identifying the location and elevation of a contributing minor cell flagged as a potential outlet and of its neighbor minor cells;

setting a trace counter equal to zero;

incrementing the trace counter by one;

exiting the further subroutine if the trace counter indicates a value greater than the maximum number of downstream cells permitted to be checked;

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obtaining data for the location and elevation of the next downstream minor cell;
testing whether that downstream cell is located at the edge of the buffered array;
if so, exiting the subroutine;
if not, further testing whether the elevation of the downstream minor cell is less
than the elevation of the flagged original minor cell;
if so, flagging the potential outlet as a good outlet and exiting the further
subroutine; and
if not, returning to incrementing the trace counter.

4-8. Replace claim 14 as follows:

Claim 14 (currently amended) The method of claim 1 wherein fixing third is a subroutine
comprising:

flagging in the memory that original minor cell in the designated major cell having a zero
flow vector value which has [[the]] a lowest elevation as compared with all other minor cells
having zero flow vector values located in the designated major cell;

retrieving from the memory the location and elevation data for the flagged original minor
cell and its neighbor minor cells;

finding and storing in the memory [[the]] a maximum slope existing between the flagged
original minor cell and one of its neighbor minor cells using the D8 method;

identifying each neighbor minor cell where the slope between that cell and the flagged
original minor cell equals the maximum slope;

marking each such neighbor minor cell in the memory as a potential path;

if there are not multiple potential paths, exiting the subroutine;

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tracing each potential path downstream from each flagged neighbor minor cell up to the specified maximum number of downstream cell iterations wherein for each iteration the maximum slope is reset in the memory to be equal to the steepest slope between a downstream cell and one of its neighbor minor cells if that slope is the steepest slope found from that downstream cell;

selecting a single potential path at random from all of the initial possible potential paths;

[[and]]

designating the selected single potential path in memory as a best path if all potential paths have been checked and either the maximum slope for each potential path equals -9999 or no potential path has a slope equal to the maximum slope or there is more than one potential path having a slope equal to the maximum slope, if either there are no potential paths remaining to be traced or if there are multiple potential paths remaining to be traced; otherwise, designating the remaining single potential path with a slope equal to the maximum slope in the memory as [[the]] a best path;

lowering the elevation stored in the memory for the first neighboring minor cell of the flagged original minor cell along which the best path runs;

recalculating and storing in the memory flow vector values for all minor cells in the buffered array ~~if the peak is fixed~~; and

~~until~~ unless all peaks are fixed or there is no more data, returning to flagging.

4-9. Replace claim 17 as follows:

Claim 17 (currently amended) The method of claim 14 wherein selecting a single potential path further comprises:

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identifying each potential flow path with a sequential number beginning at one;
dividing the number of remaining potential flow paths by two to obtain a quotient; and
~~designating the sequential number of the potential flow path~~ selecting the potential path
having the sequential number corresponding to the quotient ~~as the best flow path~~.

Reasons for Allowance

5. The following is an Examiner's statement of reasons for allowance:

5-1. The closest prior art of record discloses:

(1) A method improves flat surface treatment (Garbrecht et al., "The Assignment of Drainage Direction over Flat Surfaces in Raster Digital Elevation Models").

(2) An algorithm for the treatment of closed depressions (Martz et al., "An Outlet Breaching Algorithm for the Treatment of Closed Depressions in a Raster DEM").

(3) A treatment of flat areas and depressions (Martz et al., "The Treatment of Flat Areas and Depressions in Automated Drainage Analysis of Raster Digital Elevation Models").

5-2. The prior art does not expressly teach or render obvious the invention as recited in independent claim 1.

Treatments of flat areas and depressions in determining water flow directions of a watershed are uncovered in the prior art. However, the specific steps including exactly two main attempts to fix the problem areas for each major cell as shown in FIG. 2 was not uncovered in the prior art teachings.

Moreover, as the courts have held that "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single

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prior art reference.” Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) and “The identical invention must be shown in as complete detail as is contained in the ... claim.” Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an ipsissimis verbis test, i.e., identity of terminology is not required. In re Bond, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

Nor was a reference uncovered that would have provided a basis of evidence for asserting a motivation that one of ordinary skill in the art at the time the invention was made, knowing of the environment of determining water flow directions, would have applied the specific steps as recited in the context of the independent claim 1. Therefore, independent claim 1 has been allowed over the prior art of record.

Dependent claims are allowed as they depend upon allowable independent claim.

6. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

7. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Herng-der Day whose telephone number is (571) 272-3777. The Examiner can normally be reached on 9:00 - 17:30.

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Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: (571) 272-2100.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kamini S. Shah can be reached on (571) 272-2279. The fax phone numbers for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Herng-der Day
June 18, 2007

H.D.


KAMINI SHAH
SUPERVISORY PATENT EXAMINER